Approaches to Linguistics

A reader in the history and philosophy of linguistics

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Table of contents

Introduction

Linguistics is a broad and varied discipline, with a wide range of constituent schools, approaches, and domains. This reader on approaches to linguistics aims to explore the history of ideas in the study of language, along with important scholars, philosophies, and movements. It will also provide an overview of how certain key concepts are handled by various linguistics theories, with a particular focus on the nature of language, the aim of linguistics, and the methods of language study.

Why history and philosophy?

Superficially, it may seem that the history of linguistics bears little relevance to the current-day study of language. After all, many historical ideas about language have been discarded due to their inaccuracy or invalidity. However, there are at least three reasons why understanding the development of linguistics is important for contemporary linguisticians.

Firstly, a big-picture overview of ideas in linguistics helps to instil an appreciation of the diversity of views within linguistics. The nature of linguistics teaching means that some perspectives will necessarily be emphasised over others, due to the specialisation of the faculty, the limitations of curricula, or other factors. Considering the history of linguistics helps linguisticians to understand that there are multiple ways to approach similar issues, thereby providing a more well-rounded and extensive understanding of linguistics.

Secondly, studying the history of linguistics allows for the contextualisation of approaches and movements, particularly with regard to contributing philosophical and ideological trends. This permits a grounding of various linguistics views in terms of their intellectual tradition, and also encourages a more careful examination of the assumptions and fundamental principles of various theories.

Thirdly, a synoptic and diachronic approach to understanding linguistics enables linguisticians to recognise how their own work and areas of study fit into the larger network of ideas in linguistics. The study of language is not just diverse, but highly interconnected, and developments in different subdomains affect one another. As such, linguisticians with a broader perspective will be able to adopt a more holistic and integrative approach, considering possible inputs and implications from related subfields.

Approaching approaches

Despite the broad remit of this reader, it is not quite the same as a traditional "Introduction to Linguistics" class, in which students go through the traditional levels of linguistic analysis (phonetics, phonology, morphology, syntax, semantics, and pragmatics) and perhaps various domains of analysis (theoretical, historical, socio-, psycho-, neuro-, and computational linguistics). Rather, this reader is organised by movements and ideas, which cut across levels and domains of linguistic analysis; many of these other topics will be mentioned, but more attention is paid to ideological groupings rather than subdisciplinary groupings.

As such, this survey of approaches to linguistics requires a holistic perspective, encompassing historical, philosophical, and linguistic angles. Interpreting and evaluating the ideas explored will require not only the examination of their coherence as linguistic theories, but also their position in *context*, as well as the way they handle various linguistic *concepts*.

Context refers to the historical and ideological backdrop of various theories, and is important in placing an event in its appropriate setting. For example, it may explain why certain ideas which linguistics now takes for granted were revolutionary in their day, or why certain perspectives that now seem outdated were adopted in the first place. Understanding context allows for accurate judgement of the contributions of such ideas in terms of the linguistics knowledge of the time.

Concepts refer to important ideas and issues that span across multiple theories and movements, which may address such concepts differently. This allows for comparisons between the perspectives and principles of different ideologies, thereby describing crucial philosophical differences between different schools of thought. Important concepts include the obvious "language" and "linguistics", but also many other aspects which have been considered by many different linguisticians, such as "methods", "data", "meaning", "form", "function", and the like.

This reader is structured in a largely chronological fashion, since this provides a straightforward way to consider contexts and developments. There has inevitably been some editorial decision about what material to include and what to omit; in general, the ideas explored have had a profound impact on the field and have shaped the way linguistics has developed. We begin with an overview of pre-modern linguistics, followed by a look at the emergence of modern linguistics and the development of the structuralist perspective. This leads into the middle of the twentieth century and the introduction of generativism, typology, variationism, and functionalism, and finally we end off by exploring some recent developments and directions in linguistics.

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1 Pre-modern linguistics

1.1 Introduction

Although linguistics in its contemporary form is a relatively young discipline, language users have certainly been contemplating and studying language much earlier than the formalisation of this domain. Exploring earlier scholarly work on language allows us to understand language users' intuitions and attitudes towards language, and provides alternative perspectives on the nature of language.

1.2 Eastern traditions of linguistics

It is difficult to pinpoint the exact origin of the study of language. For example, one could argue that the development of a writing system requires some metalinguistic reflection. However, some of the earliest explicit linguistic thought arose in response to language change—when earlier forms of a language (or indeed earlier languages) were deemed significant enough to preserve (e.g., for political, cultural, or religious reasons), language information would be recorded to permit an understanding of older texts employing language forms that were no longer in use.

The oldest written records in this regard come from Mesopotamia, particularly from ancient Babylonia (Gragg, 1995). Around 2000 BCE, Sumerian was declining and being replaced by Akkadian as the language of ordinary use; however, Sumerian remained important as the language of scribal training, as well as the medium for aspects of Mesopotamian culture such as law and religion. Some material was thus collated for use in scribal school; this began with inventories of Sumerian words and their Akkadian equivalents, and later texts demonstrated more organisation into grammatical (e.g., verbal) paradigms. These texts, however, seem to be aide-mémoires rather than comprehensive descriptive grammars; they also seem to concentrate on aspects that were challenging for Akkadian speakers, and that had approximate Akkadian equivalents, reflecting their original purpose (Black, 1989). Nonetheless, they demonstrate early thought about morphology and language structure, which is particularly impressive considering that Sumerian was unrelated to Akkadian and had a different morphological alignment (ergative, in contrast with the accusative Akkadian).

In pre-modern India, linguistic analysis arose out of the need to preserve the *Vedas* ('knowledge'), which are Hindu scriptures composed in Vedic Sanskrit around the second millennium

BCE. The *Vedas* drove six ancillary branches of knowledge known as the *Vedāṅga* ('limbs of the Veda'), of which four are linguistic in nature: *chandas* (metrics, prosody), *nirukta* (etymology, semantics), *śikṣā* (phonetics), and *vyākaraṇa* (grammar) (Lochtefeld, 2002). The etymology branch initiated the tradition of lexicography (Vogel, 1979), beginning with a thesaurus of Vedic terms called *Nighaṇṭu*. The phonetics branch focused on phonetic rules and sound alternations, particularly on the difference between word-by-word recitation (*padapāṭha*) and continuous recitation (*saṃhitāpāṭha*), and also provided classifications of sounds according to articulatory features (Allen, 1953). The grammatical branch includes scholarship in the tradition of Pāṇini, whose work *Aṣṭādhyāyī* (fourth century BCE) gave a concise, coherent, and largely complete description of the grammatical structure of Vedic Sanskrit, even including rules relating to regional, stylistic, or sociolinguistic variation (Kiparsky, 1993). Later works provided additions, amendments, and commentary (Scharf, 2013), resulting in a sophisticated body of scholarship that also influenced later linguists, especially as a model of a comprehensive descriptive grammar.

Going further east, Chinese linguistic analysis originated within the field of philosophy, with reflections about the relationship between *míng* ('name', 'word') and *shì* ('actuality'); for example, Confucius advocated for the "rectification of names" to maintain social order (Confucius, n.d., p. 13.3), and Mozi suggested that names should correspond to an actual referent (Mozi, n.d., p. 10.79). Later, the emperor of the Qin Dynasty (221–206 BCE) enforced the standardisation of writing and the destruction of classical books, resulting in loss of understanding of ancient texts. When these were rediscovered in the subsequent Han Dynasty (205 BCE–220 CE), philology emerged as a field seeking to ensure accurate understanding of such classical texts. This resulted in works such as *Éryǎ* ("Approaching the Proper Language"; third century BCE), a lexicographic work containing synonyms arranged in semantic categories, and *Shuōwén Jiězì* ('discussing writing and explaining characters'; second century CE), containing descriptions and examples of Chinese character composition principles (Zhu, 2017). The Chinese linguistic tradition was also influential in other parts of ancient East Asia, and this philosophical–philological tradition continued into later periods of Chinese history.

1.3 Classical traditions of linguistics

Philology and philosophy were also intertwined in the Greek grammatical tradition. One strand of thought arose from the study of language as the medium of expressing knowledge, perceptions, and concepts. Thus, Greek philosophers discussed issues such as the relationship between language and thought, and the origin of language; in particular, the latter relates to the debate about whether the form and meaning of words were connected by nature (*phusis*) or purely by convention (*nomos* or *sunthēkē*), and a major work about this discussion is Plato's *Cratylus* (c. 385 BCE; see Joseph, 2000). Both Plato and Aristotle were also concerned with the relationship between language and reality; this resulted in investigations into meaning and language. Another strand arose from pedagogy: Descriptions of Homeric and Attic Greek were necessary in order to ensure the correct performance and interpretation of scholastic literature

(Allan, 2009). An important scholar in this tradition is the Alexandrian grammarian Dionysius Thrax, whose work *Technē Grammatikē* ("The Art of Grammar"; c. 200 BCE) established the notion of word classes (De Jonge, 2008). These works, along with others exploring etymology, rhetoric, and poetics, contributed to scholarship around the Greek language, and of language itself.

Roman linguistics continued investigations on similar themes, adopting Greek ideas for use with Latin. For example, Aelius Donatus further developed the notion of the word class and applied it to classical Latin literature in *Ars Minor* (c. 350 CE; Cornelius, 2017). Priscian later addressed classical Latin syntax in his eighteen-volume *Institutiones Grammaticae* ("Institutes of Grammar"; sixth century CE), based on earlier works of Aelius Herodian and Apollonius Dyscolus (Moran, 2022). This also became an important pedagogical source for prescriptive Latin grammars, which is significant as Latin remained the language of education and academia for centuries to come.

1.4 Western traditions of linguistics

Subsequent Western linguistic thought largely focused on Latin grammar, as its use as the ecclesiastical and scholarly language persisted even after the dissolution of the Roman Empire in the fifth century. However, Greek scholarship was largely lost to the Western world, and it was only recovered around the twelfth century through the Arabic tradition, resulting in a return to dialectics as a mode of academic thought. A group of mediaeval scholars known as the *modistae* or speculative grammarians adopted some of Aristotle's ideas, such as the idea that all humans have the same experiences of the world, and thus mental experiences (Aristotle, n.d.). As such, what is signified in language is universal, and what differs among languages is the means of signifying, or the *modi significandi*. Since these scholars also believed that language was a *speculum* 'mirror, image' that reflects the world, they further suggested that there is a 'universal' grammar common to all languages (Thomas of Erfurt, n.d.).

A contemporaneous direction was in pedagogy: As grammar was an essential component of university education, a number of pedagogical grammars were composed during this period, including Alexander of Villa-Dei's *Doctrinale* (1199). This was coupled with the increasing use of vernaculars in literature, resulting in the creation of vernacular-medium grammars modelled after the format and content of existing Latin grammars (Swiggers & Vanvolsem, 1987). These include vernacular-medium grammars of Latin, such as Ælfric's *Excerptiones de Prisciano* (in Old English; c. 1000 CE), which may have been useful to students without existing competence in Latin. There were also vernacular-medium grammars of the vernacular, such as the Old Icelandic *First Grammatical Treatise* (c. 1150 CE), demonstrating the emergence of formal thought about languages other than Latin, Greek, or Hebrew (Hayden, 2017).

Renaissance humanism in the fourteenth to sixteenth century prompted a revival of interest in classical antiquity, thereby bringing classical thought about language to the fore again. This was coupled with burgeoning exploration of the world outside Europe, and a concomitant

impulse to collect and analyse empirical data. This resulted in an expansion of European linguistic awareness, and a rapid growth in the number of European descriptions of non-European languages (Law, 2003). The arrival of the printing press also resulted in a revolution in means for information transfer, and further prompted linguistic development such as orthographic standardisation (Eisenstein, 1980). The emergence of science as a discipline and the broadening of linguistic data thus served as important foundations for the advent of the modern discipline of linguistics.

1.5 Conclusion

The histories of academic disciplines are often presented as a linear, evolutionary narrative. However, this is a misleading characterisation, and histories are more often convoluted and multidirectional. This is certainly the case for linguistics—for example, limited information transfer in the ancient world meant that Eastern linguistic traditions remained much more sophisticated than their Western counterparts for many centuries, although it was the Western tradition that eventually gave rise to modern linguistics. Examining the early origins of linguistic thought reveals that many themes that would arise in later linguistic theory actually had much earlier (and oft-forgotten) origins; thus, tracing the history of these ideas requires reaching much further afield than just the West, and much further into the past than just the modern age.

2 The historical turn

2.1 Introduction

Before the eighteenth century, much work on language was normative in nature—for example, there was an emphasis on the study of the "Three Holy Languages", namely Hebrew, Latin, and Greek. There was also a lack of a consistent and systematic approach to language study, and philosophical speculation was often included in scholarly work.

An important shift in paradigm came with Francis Bacon, who introduced the scientific method, suggesting that scholarly inquiry should be grounded in practical empiricism (Bacon, 1620). While he did not himself undertake such study, this pronouncement influenced subsequent scholars, such as Gottfried Leibniz, who (among other scholars of his time) proceeded to assemble large-scale word collections to permit language comparison (Leibniz, 1717). He also shifted the focus from historical language forms to contemporary forms, which are most accessible and comprehensively documentable (Leibniz, 1710). Leibniz also contributed the notion of genealogical relationship of languages, and suggested that these have to be elucidated by comparing all aspects of languages (i.e., not just the lexicons) (Jankowsky, 2013). This theoretical framework paved the way for the emergence of historical and comparative linguistics.

2.2 The nascence of modern linguistics

One motivating factor contributing to the emergence of linguistics was the growth of knowledge on Sanskrit due to the British colonisation of India. This development provided a new source of data, but also generated interest in the topic of languages. A historically esteemed figure in this period is Sir William Jones, who went to the South Asian subcontinent as a judge, but became an important philologist, and advanced the scholarly landscape there by founding the Asiatic Society of Bengal, an organisation designed to further research regarding the East. Jones was already well-versed in Persian and the classical languages, and while seeking to understand local culture, he learned Sanskrit and compared it to Greek and Latin, noting that it bears "to both of them a stronger affinity … than could possibly have been produced by accident" (W. Jones, 1807). It is important to note that Jones' observation isn't original—Campbell (2017) lists a number of scholars who had presented the concept of Indo-European before Jones. Furthermore, Jones provided no linguistic evidence either. Nonetheless, Jones lent it

the influence and authority needed to bring recognition to this hypothesis, and it encouraged other scholars to engage in similar linguistic comparison. It should also be noted that Jones himself retained some legacy notions about the subjective quality of a language (e.g., describing Sanskrit as having a "wonderful structure" and being "more exquisitely refined" than either Latin or Greek), and believed that language data is related to the history and taxonomy of nations and races (which in fact led to his misclassification of both Indo-European and non-Indo-European languages). These ideas persisted into the early twentieth century, although scholars were already dismantling such ideas in the nineteenth century.

Examples of such scholars include Schlegel, who demonstrated the genealogy of relationships by comparing both words and grammatical forms, emphasising the need for procedures as rigorous as those in the natural sciences (Schlegel, 1808). He suggested that similarity in words may be due to mutual borrowing, and instead that grammatical similarity was the crux in determining relatedness, by analogy of the elucidation of evolutionary relationship through comparative anatomy. Importantly, he stated that linguistic data should be separated from historical and cultural facts, thereby focusing linguistic study solely on linguistic material. However, Schlegel preserved normative conceptions of language, considering inflected language to be 'organic' and 'superior'.

In contrast, von Humboldt recognised that various linguistic characteristics "do not decide the pre-eminence of languages to one another" (von Humboldt, 1836). Von Humboldt also helped construct various epistemological and methodological bases that persist in contemporary historical linguistics. Part of his legacy is his explication of the fundamental principles behind the comparative method (von Humboldt, 1830) with an emphasis on empirical data, as well as his astute observation that language is continuously changing and morphing with "never a moment of true standstill" (von Humboldt, 1836). His use of a large amount of linguistic material from multifarious languages (including Basque, Chinese, indigenous languages of the Americas, and Polynesian languages, among others) was particularly important in extracting methods that were not confined to Indo-European languages, but which could apply to data from any family of languages.

This emphasis on a data-driven approach was picked up by other scholars of the time, including Bopp, whose first major work *Konjugationssystem* (Bopp, 1816) was an extensive comparison of Indo-European languages intended to "put an end to all by-chance matters" and securely establish a valid model of the relationships within this language family. Grimm also emphasised an empirical approach, and himself accumulated large amounts of philological data, leading to his description of the Germanic consonantal shift now known as Grimm's law (voiced aspirated stop > voiced stop > voiceless stop > voiceless fricative) (Grimm, 1819). Again, this correspondence is not original (having at least been noticed by Rask, 1818); nonetheless, Grimm's work was accompanied by extensive textual documentation and provided a formal description for the phenomenon. Together, the work of these early scholars described a coherent methodology for historical linguistics.

2.3 The development of historical linguistics

From the middle of the century onwards, linguistics began to expand as a discipline, with various scholars contributing grammars and comparative analyses of many different languages, including those of Africa, Asia, and the Pacific islands. This period introduced novel formal conventions for working in historical linguistics. On one hand, there was an increasing emphasis on the use of phonetic descriptions in understanding sound change, in contrast with earlier work, which was primarily phonological or even orthographic. This was advocated by historical linguisticians who were also adept phoneticians, such as Sievers (1876).

On another hand, Schleicher introduced innovations for representing the theories that arose in historical linguistics, including the Stammbaum or family-tree model of language descent (Schleicher, 1861)—which is still used to identify and represent genealogical relationships, even if the model has since been superseded. He also introduced the use of reconstructed proto-language forms as a basis for establishing relationships between languages, along with the convention of using an asterisk to indicate reconstructed items. This research direction contrasted with prevailing views that Sanskrit was the source of all Indo-European languages due to the antiquity of its materials; instead, Grassmann found that Germanic was "older" in one phonological pattern than Sanskrit was (Lehmann, 1967), and work by both Grassmann and Schleicher established the empirical and explanatory need for the positing of proto-languages. It is interesting to note that Schleicher's innovations arose by analogy of work from evolutionary biology; indeed, he believed that languages behave like natural organisms, evolving without the conscious input of their users, and hence were amenable to the same analyses used in the natural sciences (Schleicher, 1863).

Another ideological contribution of Schleicher's is an insistence that sound laws be as regular as possible, foreshadowing the work of the Neogrammarians (Schleicher, 1861). This idea was expressed in the work of scholars who contributed further refinements in the analysis of sound correspondence data. Such scholars include Grassmann (1863), who found that some Sanskrit forms had undergone dissimilation of two aspirated stops in adjacent syllables, with the first losing its aspiration; this explained some correspondences with their Germanic cognates that were previously considered exceptions to Grimm's law. Ascoli (1870) similarly suggested that Proto-Indo-European had both velars and labiovelars, which could explain differences in correspondences with Greek stops. These developments hint at increasing thought about the nature of language change, rather than merely its description, and also demonstrated a tendency towards increasing precision in describing and theorising about language data.

2.4 The Neogrammarians

At the end of the century, a new school of historical linguisticians arose both in reaction to and in culmination of the previous decades of work in the discipline; these were the *Junggrammatiker*, or the Neogrammarians. This school is defined by the principles with which they

approached historical linguistics: that language does not have a speaker-independent reality, and that the human factors affecting language are constant (the uniformitarian principle). These resulted in a number of methodological principles as well: that sound change occurs without exception (the regularity principle), and that analogy is an important mechanism of language change. Such principles were definitively articulated in what is often known as the "Neogrammarian Manifesto" (Osthoff & Brugmann, 1878). These principles were controversial as they were in opposition to some of the ideas of earlier scholars (e.g., Schleicher's suggestion that language development occurred in two distinct stages of language formation and language decay), but arose out of a desire to remedy the imprecision of earlier descriptions of linguistic relationships, and to render the discipline as rigorous as the natural sciences. Furthermore, the positing of exceptionless sound laws is necessary to give the comparative method an adequate theoretical basis, since this mitigates the need to determine how 'similar' forms need to be to be considered related (since it is systematicity that is more important; Harrison, 2003).

Central to their efforts were attempts to account for all instances of phonological change, including both phonemic and suprasegmental phenomena. To this end, Karl Verner (who was only loosely associated to the group) played an important role: he demonstrated that a large swathe of residues from Grimm's law could be accounted for by positing the voicing of voiceless fricatives immediately following an unstressed syllable in Proto-Germanic (now known as Verner's law; Verner, 1875), thereby encouraging the Neogrammarians to pursue a total accounting of the phonological data. This demand for accounts of data that are as accurate as possible has certainly persisted as a methodological ideal in the field of linguistics.

Much subsequent work has investigated the validity of the Neogrammarian hypothesis, and while this topic more appropriately belongs in historical linguistics itself, one point worth mentioning is that the Neogrammarian "sound change" refers exclusively to a particular type of phonetic change (i.e., that is completely regular and lexically abrupt), and indeed they attribute many apparent counterexamples to other language change processes, namely borrowing and analogy (Chen & Wang, 1975). Thus, part of the Neogrammarians' work was to determine which particular process best described an instance of language change, which also became an important aspect of the comparative method (i.e., deeming whether words are cognate or merely borrowed).

Another theoretical direction is the psychologism introduced by Hermann Paul (1880), suggesting that language must be understood as a mental process. This perspective allowed variation across both space and time to be explained as variation in speakers' production and in listeners' interpretation, thereby constructing a single theory that incorporates social, psychological, and physiological factors to explain why languages change at all. It also explains the Neogrammarians' focus on the idiolect (rather than an abstract language system) as the primary object of linguistic investigation. The Neogrammarians were thus a source of many theoretical innovations that drove newer fields of research, even if some of their hypotheses were later refuted or superseded.

2.5 Conclusion

The eighteenth century was a foundational period for linguistics, with a focus on the historical aspects of linguistic study. It helped to identify language as a possible target of scientific study, and prompted thought on data gathering, analytic techniques, and formal descriptions. These themes would remain essential in practically all subsequent work on language. This period was also the source of ideas about language change and the relationship between languages, which remain important in the field of historical linguistics to this day.

3 European structuralism

3.1 Introduction

Linguistic thought in the nineteenth century was dominated by a historical focus, which led to increasingly sophisticated descriptions of language change. However, there had not been coherent conceptions of "language" itself. The prevailing positivism also meant that scholarship often adopted an atomistic perspective—i.e., the idea that only individual facts are relevant objects of study. Instead, the structuralist school argued that the *relationships* between these should be studied (Albrecht, 2011). Within the realm of linguistics, this movement suggested that language can be analysed as a well-structured system, and elucidating the nature of that system became the focus of the European structuralists of the early twentieth century.

3.2 Ferdinand de Saussure

It is undeniable that de Saussure is a major figure involved in the emergence of the structuralist movement. Interestingly, his earlier work was rather Neogrammarian in nature (e.g., he published a book on the Indo-European vowel system in 1878; de Saussure, 1878). Later, however, he became less certain of those ideas, and this change was reflected in a declining frequency of publication. During this period, he sought to characterise linguistic study and its aims, and these ideas entered into three courses in general linguistics that he gave at the University of Geneva. The material from these courses was consolidated by two former students, Bally and Sechehaye (who had not actually attended these courses themselves), and this was eventually published as the *Cours de Linguistique Générale* (de Saussure, 1916), which laid the foundational work for structural linguistics.

In *Cours*, de Saussure presented several key dichotomies on topics including the approach of linguistics, the object of linguistic study, and linguistic semiotics. The first distinction is that between synchronic linguistics, concerned with the state of a language at one particular point in time, and diachronic linguistics, concerned with the change in one particular aspect of a language over time. Unlike his predecessors, de Saussure suggested that synchronic linguistics should be primary, as language users do not need to know the diachrony of their language in order to use it. The opposition between these two axes can be summarised as follows: "synchronic facts are systematic and meaningful; diachronic facts are isolated and ateleological (i.e., without a goal)" (Graffi, 2013).

Another distinction is that between *langue*, the total system of a language across the language community, and *parole*, the execution of language by an individual via acts of speech. To de Saussure, language was primarily a "social fact" (rather than a psychological one), and linguistic study should aim to describe *langue* by studying *parole*, which reflects and represents the *langue* of the society that the individual belongs to. De Saussure also distinguished these two from *langage*, or the human faculty of language, which contributes to both *langue* and *parole* but is distinct in its psychological nature.

De Saussure also contributed to linguistic semiotics by distinguishing between the *signifiant*, the form of a sign (the sound-image of a sign), and the *signifié*, the concept designated by a sign. He further suggested that the relationship between the two is arbitrary (i.e., without logical connection) as opposed to motivated (i.e., with resemblance between *signifiant* and *signifié*). It is important to note that de Saussure's conception of this relationship relates not primarily to the relationship between language and reality (which had been commented on before), but a relationship internal to language. That is, the *signifié* is not a real object, but rather an abstract concept embedded in a language.

Language, then, comprises a number of signs that are delineated in opposition to one another within the system of a language. The relations between signs can be analysed in the syntagmatic dimension (i.e., relationships between a sign and the signs before and after it) and in the paradigmatic dimension (i.e., relationships between a sign and other alternative signs that could have filled its location in the syntagm); thus, the meaning of a word is constructed by the oppositions between a word and other words in its syntagm and paradigm. De Saussure captured this notion by comparing language to chess, suggesting that in both systems, units were valued in relation to other units. This idea is the "structure" referred to in structuralism, and reflects a core ideology that anchored this movement, despite the considerable differences both among and within the various schools of European structuralism that emerged after de Saussure.

3.3 The Geneva School: Return to psychologism

It has sometimes been claimed that much of the material in the *Cours* is in fact based on the ideas of its editors, Bally and Sechehaye, who brought the book together by referencing the notes taken by students who had attended de Saussure's lectures (Engler, 2004). Regardless of the veracity of this claim, it is clear that scholarly work by both editors demonstrated key differences in their philosophies of language as compared with de Saussure, particularly in their adoption of a mentalistic view of language. It is seemingly paradoxical that the scholars who were closest to de Saussure should have experienced the least influence from him; this observation, however, can be resolved by noting that Bally and Sechehaye had already developed their own viewpoints before de Saussure had delivered his lectures, explaining the divergence in thought (Graffi, 2013).

This is evident in Sechehaye's first book, which appeared before the *Cours* in 1908 (Sechehaye, 1908). In it, he suggested that the primary issue in theoretical linguistics involved the "grammatical problem", referring to the "psychophysical basis" of grammar. Later, he also disagreed with de Saussure's conception of *langue*, suggesting instead that language does not exist as an entity over and above individuals' language (Sechehaye, 1933).

Bally focused on a different issue, concerning the "intellectual" and "affective" components of language—the former refers to the content of an utterance, while the latter refers to additional information regarding the speaker's emotions, intentions, and so on, which are inevitably transmitted during actual conversations due to the communicative, dialogical nature of language use (Bally, 1926). He went on to study the effects of both components, a discipline which he termed "stylistics". Some of Bally's other ideas, however, do seem to be inspired by de Saussure, including his suggestion that *parole* is the actualisation of *langue* (Bally, 1932).

3.4 The Prague School: Functionalism and phonology

Some of the Genevans' focus on the communicative functions of language can also be seen in the Prague school. For example, Mathesius developed a framework for sentence analysis distinguishing between a "grammatical analysis", which subdivides a sentence into the traditional subject and predicate, and an "actual analysis", which subdivides a sentence into theme and rheme (Mathesius, 1929). These two analyses are both essential and may not coincide. This perspective, while not particularly popular in the early twentieth century, went on to inform the later school of structural functionalism.

Mathesius was also important for his organisational work—he founded the Prague Linguistic Circle in 1926, bringing together influential European structuralists, including the Russian linguisticians Trubetzkoy and Jakobson. A significant contribution of this group is its "1929 Theses" ("Thèses Présentées Au Premier Congrès Des Philologues Slaves," 1929), which expressed their conception of language and linguistic study. Particular theses worth highlighting include the first thesis, which opposed de Saussure's sharp division between synchrony and diachrony, and instead suggested that particular stages of a language still contain traces of earlier stages. Jakobson later picked this idea up in the field of historical phonology (Jakobson, 1975), which looked at systematic sound changes over time, and he was also interested in how children's phonological acquisition could also reflect cross-linguistic phonological histories (Jakobson, 1968). The third thesis reflected Mathesius' functional view of language, suggesting that different linguistic functions (e.g., communicative, referential, poetic) must be considered in an adequate account of language; this theme was also revisited by Jakobson in his later work (Jakobson, 1960).

A thesis that came to shape much of the Prague school's scholarly work is the second thesis, distinguishing between sound as "an objective physical fact" and as "an element of a functional system"; this notion was foundational in the emerging field of phonology. Trubetzkoy distinguished between phonetics, which he defined as the science of sounds "pertaining to the acts

of speech", and phonology, the science of sounds "pertaining to the system of language" (Trubetzkoy, 1939). Thus, the former studies the acoustic and articulatory properties of linguistic sounds, while the latter studies linguistic sounds in terms of their "distinctive functions" (i.e., position within a paradigm). This leads naturally to the now-familiar notion of the phoneme, the basic mental unit of sound whereby the substitution of one for another creates a minimal pair; in Trubetzkoy's words, "the primary object of phonological study is, in fact, the types of sound opposition that can create distinctions in meaning" (Trubetzkoy, 2001).

Jakobson further developed some of Trubetzkoy's ideas on the contrasts between phonemes, suggesting the concept of the distinctive feature—i.e., particular characteristics of a phoneme whereby substitution of one feature results in a different phoneme, and suggested that these are binary in nature (Jakobson & Halle, 1956). He also proposed specific features such as "lightness/darkness" (i.e., frontness/backness), "chromatism" (i.e., openness/closeness), and oral/nasal. Thus, the phoneme can be reformulated as "a bundle of distinctive features", providing a framework for a systematic organisation of phonemes, rather than an unsystematic "stamp-collecting" approach to cataloguing the sounds used in various languages.

3.5 The Copenhagen School: Further semiotics

Unlike the Prague school, the Copenhagen Linguistic Circle did not share a common theoretical perspective. Arguably the most significant figure of this school is Hjelmslev, who further developed a framework for semiotics by extending Saussure's sign model (Hjelmslev, 1953). He renamed the Saussurean *signifiant* and *signifié* as the expression plane and the substance plane respectively, and further distinguished between form (language-internal aspects of language) and substance (extrinsic aspects of language). In his view, expression-substance (articulable sounds) and content-substance (concepts) are ancillary, but should not be the focus of linguistic study. Instead, he proposes that the relationships between expression-forms and content-forms should be the object of linguistics, and thus developed the methodology of glossematics (with a glosseme being the smallest unit of both expression-form and content-form). While this approach did not gain much traction in linguistics, it remains a cornerstone of modern semiotics.

3.6 The London School: Studying *parole*

The loosely-termed "London school" typically refers to Firth and his students, who, while having been influenced by de Saussure and continental structuralism, developed their own framework in the study of language. For example, Firth's own work aimed at analysing language in terms of its embodied use in particular situations, rather than an abstract supra-individual language structure. He suggested that meaning could not be understood independently of the

situational context and the linguistic collocation (or co-text), thereby emphasising the syntagmatic dimension of relations (Firth, 1958). These ideas served as a precursor to later work in semantics and pragmatics.

3.7 Conclusion

The twentieth century was a pivotal period for linguistics, containing some of the earliest formulations of the concept of "language" itself. The Saussurean idea of language as system was implemented in many different ways by the different European schools of structuralism, but to encapsulate the essence of European structuralism, we return to de Saussure, who reiterates that "the linguist[ician] must take the study of linguistic structure as his primary concern" (de Saussure, 1916). In that regard, arguably all of subsequent linguistics is structuralist in nature, since the scientific study of language presupposes that it is ordered rather than random, demonstrating the far-reaching effects of de Saussure's fundamental contributions.

4 American structuralism

4.1 Introduction

American linguistics began in earnest around the twentieth century, spearheaded by scholars who were influenced by the then-flourishing European structuralism. While American structuralists maintained some of the traditions of their European counterparts, such as the emphases on synchrony and systematicity (Joseph, 1999), they also contributed to linguistic thought in two key ways, namely a focus on data-driven linguistics, and a refinement of analytical tools. These helped to establish important concepts and methodologies that influenced subsequent schools of linguistic thought, and still play a role in modern linguistic understanding.

4.2 Linguistics as anthropology

Early American structuralist thought considered linguistics to be an offshoot of anthropology. Many early American linguisticians including Boas, Sapir, and Whorf were also involved in anthropology, and much of their work was driven by a desire to describe Native American languages, which were facing possible extinction (Hymes & Fought, 1981); indeed, Boas' descriptions of some now-extinct Native American languages were the last (and sometimes the only) significant sources of data on them (Campbell, 2017). This research led to discourse about how language relates to ethnography, and introduced perspectives from anthropology such as an emphasis on the equal worth of all cultures and languages (Boas, 1911), thereby refuting earlier "evolutionary" views of language (which purported that the morphological type of a language reflected the stage of social evolution of its associated society; Schleicher, 1861).

An alternative interpretation, also arising from concurrent anthropological and linguistic work, is that language and culture may be related; this has led to the development of the Whorfian hypothesis (Whorf, 1956), which suggests that a language determines its speakers' thoughts and cognitive categories. This hypothesis has aroused significant interest and research into the topic, and resulted in interdisciplinary efforts in linguistics, anthropology, and psychology; most current evidence seems to suggest that the strong form of the hypothesis is false, but that language does influence thought in certain (more minor) ways (see e.g., Danesi, 2021; Gentner

& Goldin-Meadow, 2003; Hunt & Agnoli, 1991; Khishigsuren et al., 2025; Niemeier & Dirven, 2000).

4.3 Phonetics and phonology: A methodological overhaul

The drive to describe each language on its own terms resulted in dramatic changes in the approach to data collection; this shift was particularly apparent in the domain of phonetics and phonology. Traditional descriptions often carried Eurocentric biases, and earlier linguisticians had perceived more "primitive languages" to have less accurate pronunciations. Instead, Boas demonstrated that this phenomenon was due to effects of "perception through the medium of a foreign system of phonetics" (Boas, 1911), particularly due to the fact that the phonetic inventories of different languages vary significantly, and may not use the same category boundaries. This reflects Boas' anthropological perspective, and was important in challenging linguisticians to create more accurate descriptions of other languages' phonologies.

An appreciation of this non-isomorphic relationship between physical sounds and linguistically relevant sound categories also led to further characterisations of the distinction between phonetics and phonology. For example, Sapir emphasised that "sounds and sound processes of speech cannot be properly understood in such simple, mechanical terms" (Sapir, 1925). He proposed that non-speech oral sounds (such as blowing out a candle) may require similar gestures to produce and may be acoustically similar to actual speech sounds, but the two are distinct in several ways. The former are functional while the latter have no direct functional value; each act of blowing out a candle is functionally equivalent while speech sounds have no unifying reference; no variation in blowing extends over into a substantially different class of actions; and most importantly, speech sounds can be placed into a system.

The notion of a phonemic system thus developed in parallel with the work of European structuralists such as Trubetzkoy and Jakobson. In particular, Chao (1934) defined the phoneme as a class of sounds (i.e., phones, or even instantiations of phones) in a language, such that they are distinctive—on one hand, words that are considered to have different pronunciations differ either in the order or in the constituency of such classes, and on the other hand, only the relevant features are specified, while other irrelevant features are unspecified (e.g., whether [t] is dental or alveolar). As such, he emphasised the importance of the distinction between phonetic (narrow) transcription and phonemic (broad) transcription—the former includes all phonetic detail, even if they have no bearing on distinctiveness of words, while the latter only refers to features that are relevant in distinguishing words. These ideas helped to pave the way for accurate phonemic descriptions of non-Indo-European languages, with particular care given to non-egocentrism (that the linguistician did not use their prior conceptions or assumptions about phonemic systems to describe a different language); indeed, much of the lasting impact of the American structuralists comprises the quantity and quality of the language data they collected, leading some to call them "American descriptivists" instead (e.g., Blevins, 2013).

4.4 Grammar: The representational turn

Another consequence of the view that language is part of culture is the characterisation of language as having a primarily communicative function. This approach resulted in a focus on sentence-level morphosyntax, as explained by Boas: "Since all speech is intended to serve for the communication of ideas, the natural unit of expression is the sentence" (Boas, 1911). For example, Z. S. Harris (1946) described a method to formally construct utterances as sequences of morphemes using an operation he terms "substitution"—that is, the replacement of morphemes or sequences of morphemes with other sequences that belong to the same class (e.g., the replacement of a noun with a determiner-adjective-noun sequence). This provided a "compact description of the structure of utterances in the given language" (Z. S. Harris, 1946) in the form of equations that resemble modern phrase structure rules (e.g., "A + N = N"), and provided a technique to compare the syntactic structures of different languages in a formal manner—for example, Harris compares the grammars of English and Hidatsa. Wells (1947) further extended this notion by describing a method of deriving these "immediate constituents" from utterances (i.e., an analytic approach, rather than Harris' synthetic one). Finding successive layers of immediate constituents and describing their relationship thus became the focus of syntactic analysis (Gleason, 1955), providing a robust and systematic approach to understanding syntax that was not modelled after familiar or "superior" languages such as Latin or Greek.

Extrapolating the difference between items and arrangements, Bloomfield (1933) distinguished between lexical form and grammatical arrangement, reiterating the primacy of the sentence. He further described a novel conceptual system that would encompass phonology, morphosyntax, and even some aspects of semantics and pragmatics:

		Lexical	Grammatical
Smallest unit of linguistic signalling	Pheneme	Phoneme	Taxeme
Smallest meaningful unit	Glosseme	Morpheme	Tagmeme
Meaning of unit	Noeme	Sememe	Episememe

Bloomfield's model was critical in suggesting that grammatical processes such as selection and ordering can be meaningful—that is, choosing one construction (e.g., an imperative) over another (e.g., a declarative) conveys meaning (episememe) above and beyond the lexical meaning of the components (sememe) in the sentence. This approach was furthered by his student Pike into the field of tagmemics (Pike, 1967), which considered how hierarchical linguistic structures (e.g., morpheme > word > phrase > sentence > paragraph > discourse) could be understood in terms of the tagmemes of different levels of organisation. It should be noted that Bloomfield and Pike had slightly different conceptions despite using similar terms (Blevins, 2013), and although this method was not generally adopted subsequently, there are echoes of a similar emphasis on arrangement patterns in later construction grammar approaches (Lakoff, 1977).

This also demonstrates the American structuralists' shift in focus from studying the properties of languages to the properties of the analytical devices themselves (Blevins, 2013).

4.5 Behaviourism

Within the field of psychology, earlier psychodynamic theories emphasised the role of (conscious or unconscious) mental processes, which were often unable to generate empirically testable hypotheses. This failure led to the opposing school of behaviourism, spearheaded by scholars such as Skinner and Bloomfield, which focused on measuring and explaining observable behaviour. Specifically, behaviourism suggested that all behaviour could be understood as responses to stimuli, modulated by prior reinforcement and punishment events in the individual's history.

In the field of linguistics, behaviourists considered language to be a type of human behaviour, which was thus explainable using behaviourist concepts of conditioning and stimulus–response sequences (Skinner, 1957). In particular, Bloomfield suggested that "language enables one person to make a reaction … when another person has the stimulus" (Bloomfield, 1933). He proposed that language is employed when one person receives a stimulus, and produces a speech (or substitute) re-action, which then serves as a speech (or substitute) stimulus for another person, resulting in a reaction (Bloomfield, 1926, 1933). Bloomfield illustrated this with an example: If Jill sees an apple in a tree and is hungry, she may make an utterance to Jack, which would cause him to climb up the tree and retrieve the apple for Jill, who can then eat it. As such, Bloomfield suggested that speech is "only a way of getting one's fellow-men to help … worthless in itself, but a means to great ends" (Bloomfield, 1933); this demonstrates Bloomfield's notion that language is fundamentally social in character (Ryckman, 1986). Bloomfield further suggested that language could be understood mechanistically—that is, given a particular stimulus and the life history of an individual, the response (including speech reactions) is determinable, and that variability in possible responses "is due only to the fact that the human body is a very complex system"(Bloomfield, 1933).

This conceptualisation of language is also related to theories of language acquisition. Bloomfield suggested that language behaviour arises from a process of habit development. Children's speech begins with (approximate) imitation, which becomes increasingly like adult speech through reinforcement of correct utterances (e.g., receiving a doll after uttering "doll" correctly) and punishment of incorrect utterances (e.g., ignored requests) (Bloomfield, 1933). Such reinforcement and punishment change the strengths of various verbal responses, until children's speech becomes fully perfected.

Significantly, the behaviourist framework influenced their perceptions of the aim of linguistic theory. Bloomfield suggested that studying language involves studying the "coordination of certain sounds with certain meanings", with meaning referring to "the important things with which the speech-utterance … is connected, namely the practical events [preceding and proceeding from the speech-utterance]" (Bloomfield, 1933). To Bloomfield, the only possible target

of scientific study was observable phenomena, which would include these "practical events" as well as the speech utterance itself; he suggested that it is the speech signal in particular that linguisticians should concern themselves with. This also reflects Bloomfield's structural approach to linguistic research, and his theory that form (phonology) must be considered in relation to meaning (semantics, which for Bloomfield included grammar): "In language, forms cannot be separated from meanings. It would be uninteresting and perhaps not very profitable to study the mere sound of a language without any consideration of meaning" (Bloomfield, 1943). For Bloomfield, the objective of linguistic theory was thus to characterise the nature (form and meaning) of the speech signal through formal analysis of observable evidence.

It is important to comment on some of the implications of the behaviourist approach. Their acceptance of the anthropological prohibition against generalisation meant that the behaviourists could not evaluate their descriptions against a general theory regarding human language. Simultaneously, their rejection of mentalism implied that they could not evaluate their descriptions against native speakers' mental knowledge about the language. As Campbell notes, this means that "nothing remained except method, 'discovery procedures,' the search for contrast and complementary distribution in the data recorded by linguists" (Campbell, 2017).

4.6 Conclusion

Given the development of behaviourism into methodology without theory, it is not surprising that this framework failed to gain traction in linguistics. Nonetheless, American structuralism's primary impact was in enhancing the rigour of empirical data collection and encouraging reflection on the analytical methods employed. The fact that many of their ideas (e.g., precise phonetic transcription, constituency analyses) are taken for granted in contemporary linguistics demonstrates the extent of their legacy, which continues to influence the way linguisticians observe and process linguistic data.

5 Generativism

5.1 Introduction

It is undeniable that one of the most important figures in modern linguistics is Noam Chomsky. In the middle of the twentieth century, he became a prominent opponent to behaviourist linguistics, and adopted a more mentalist approach, suggesting that mental processes could be a valid object of scientific study. He introduced the school of generativism, which was marked by its commitment to linguistic essentialism, focusing on "abstract universal principles that explain the properties of specific languages" by measuring native speakers' intuitions about language, as well as linguistic nativism, the notion that linguistic capabilities are, to some extent, dependent on structures and processes that are innate to humans, rather than acquired through domain-general learning processes (Scholz et al., 2024). These ideologies resulted in a novel and robust framework for conceptualising language and the aim of linguistic study.

5.2 Against behaviourism

The behaviourist framework purported that observable behaviour is the only evidence appropriate for scientific study, and that all behaviour is explainable via the process of conditioning, in which an agent's responses adjust in relation to other events. Thus, under this view, language use occurs solely as a response to particular stimuli, and is purely instrumental in nature. However, Chomsky's (1959) scathing review of Skinner's (1957) *Verbal Behavior* dismantled many of the claims of behaviourism, and has even been claimed to be "the single most influential paper published since Watson's Behaviorist manifesto" (Leahey, 1987), and to have "sounded the death-knell for behaviorism" (Smith, 1999).

A crucial aspect of Chomsky's review is his criticism of the notions of stimulus and response used in relation to verbal behaviour. He suggested that these are not well-defined, and that a broader definition of these terms ("any physical event to which the organism is capable of reacting" and "any part of behavior" respectively) would result in the relationship between stimulus and response no longer being valid. Indeed, part of the behaviourist argument relies on internal stimuli and automatic self-reinforcement to explain continued speech production, even though these are not directly observable; Chomsky proposed that these may merely be cover terms "for any factor, detectable or not, related to acquisition or maintenance of verbal behavior" (Chomsky, 1959), thereby questioning the behaviourists' purported restriction of

linguistic study to observable behaviour. In contrast, Chomsky considered language to be an abstract object, "a set (finite or infinite) of sentences, each finite in length and constructed out of a finite set of elements" (Chomsky, 1957). This object is describable by a grammar, which can generate all the grammatical sentences of a language. In his view, the observable behaviour of language production is merely a reflection of this abstract object: "Behavior is evidence. It's not what you are studying; what you are studying is competence, capacity" (Virués-Ortega, 2006). This demonstrates his mentalist position, emphasising the mental processes and capacities of an individual that underlie observable language use.

Chomsky's views on the nature of language also explains some of his criticisms on the behaviourist notion of learning. Contrary to the claims of Bloomfield, Chomsky noted that much of children's language acquisition is not accompanied by "careful differential reinforcement" of adults, but merely arises from "casual observation and imitation of adults and other children" (Chomsky, 1965). These critiques were later supported by empirical work, which showed that parents do not provide positive verbal reinforcement for sentences that are grammatical, but rather reinforce truthful ones (Brown & Hanlon, 1970; cf. Schoneberger, 2010). If the behaviourist hypothesis were correct, this would make our language behaviour truthful but ungrammatical, which is the opposite of what we find in adult humans. Instead, Chomsky proposed that children have some innate linguistic knowledge which "specifies the form of the grammar of a possible human language", as well as "a strategy for selecting a grammar of the appropriate form that is compatible with the primary linguistic data" (Chomsky, 1965). This nativism is captured in his comment that "there is surely no reason today for taking seriously a position that attributes a complex human achievement entirely to months (or at most years) of experience, rather than to millions of years of evolution or to principles of neural organization that may be even more deeply grounded in physical law" (Chomsky, 1965).

Contemporary studies in psycholinguistics also provided another source of evidence against the simplistic view of behaviourism. An example is Berko's seminal *wug* test (Berko, 1958), which demonstrated children's ability to generalise morphological rules to novel lexical items (e.g., responding with *wugs* when prompted to provide a plural form for *wug*). This suggested that "the acquisition of language is more than the storing up of rehearsed utterances" (Berko, 1958), demonstrating that humans' language capacity is more robust and flexible than can be accounted for by rigid behaviourist descriptions.

5.3 Understanding generativism

Chomsky's assumptions that language was a mental capacity and infinite in size informed his perspective that the aim of linguistic theory should be the description of grammars that can fully describe individual languages, and language more generally. At the language-specific level, the fact that finite grammars must be used to describe infinite languages suggested that it must employ "recursive devices of some sort" in order to generate the grammatical sentences of the language, giving rise to the generative grammar approach to linguistics (Chomsky, 1957).

His characterisation of language as a mental capacity also suggested that it could be affected by various other non-linguistic factors (e.g., attention, memory). As such, Chomsky distinguished between performance theories, which aimed to characterise observed behaviour, and competence theories, which aimed to describe the mental representation of language users' linguistic knowledge (Chomsky, 1964). He employed evidence other than observed utterances, such as linguistic intuitions, attempting to "abstract from the observation a more perfect class of behavior than that presented by any one record" (Pylyshyn, 1973). For Chomsky, performance theories could only aim for observational adequacy (providing an accurate description of observed data), while competence theories could further aim for descriptive adequacy (accounting for linguistic intuition), and are therefore the more appropriate goal for linguistic inquiry. This is related to the distinction between competence ("knowledge of language") and performance ("ability to use that knowledge")—the latter is affected by other performance factors, such as memory and attention, which Chomsky considered irrelevant to language itself (Chomsky, 1986).

Chomsky later refined his conception of the object of linguistic study by proposing a distinction between I(nternalised)-language and E(xternalised)-language (Chomsky, 1986). I-language is "some element of the mind of the person who knows the language", and is intended to be a mnemonic for three characteristics: individual (a property of individual human beings rather than groups), internal (relating to representations in the mind), and intensional (defined by a formal specification) (Chomsky, 1992). This concept contrasts with E-language, which is external (relating to representations outside the mind) and extensional (defined by enumerating the set of permitted strings). Chomsky suggested that E-language is a poor candidate for linguistic study as it is an "artificial, somewhat arbitrary" construct (Chomsky, 1986), while I-language refers to a real-world object (i.e., an actual state of the mind/brain of a native speaker), and should be the focus of linguistics.

Another key component of the generativist philosophy of language relates to the language acquisition process. Chomsky notes the problem of the "poverty of stimulus"—i.e., that theories of language acquisition have to account for "the richness, complexity, and specificity of shared knowledge, given the limitations of the data available" (Chomsky, 1986), such as speech errors, incomplete utterances, and the finiteness of actual utterances. In other words, posited acquisition processes must be able to account for the development of robust I-language despite the influence of performance factors on the primary linguistic data received by the acquirer. To account for this, Chomsky proposed a "language acquisition device", which is "an innate component of the human mind that yields a particular language through interaction with presented experience" (Chomsky, 1986).

Combining this with the concept that knowledge of language can be conceived as states of the mind/brain, he suggested that the language faculty can be described as having an innate initial state S_0 common to all humans; this then develops through relevant experience into a steady state S_S, which is the state of knowing a particular I-language. Chomsky thus introduces universal grammar (UG) as a theory about S_0, or a "characterization of the genetically determined language faculty" (Chomsky, 1986). Furthermore, since this UG must be able

to account for the fact that S_0 can develop into many dissimilar I-languages, UG can also be considered as a "framework of principles and element common to attainable human languages" (Chomsky, 1986). Thus, Chomsky suggested that the primary objective of linguistic theory is "to develop an account of linguistic universals that, on the one hand, will not be falsified by the actual diversity of languages and, on the other, will be sufficiently rich and explicit to account for the rapidity and uniformity of language learning, and the remarkable complexity and range of the generative grammars that are the product of language learning" (Chomsky, 1965).

5.4 The language bioprogram hypothesis

A related research direction was taken by Bickerton, who sought to understand the underlying language faculty by considering another case of deficient language input: creole genesis. He observed that creoles have greater complexity of morphosyntax than the pidgins that precede them, and further claimed that many creoles with disparate super- and substrate languages nonetheless share certain similar features, such as having a tense–modality–aspect system with such morphemes occurring in that order. These phenomena occur despite the fact that the input data exhibit significant variability and lack models for complex structures; this environment is known as "linguistic chaos".

He thus proposed the language bioprogram hypothesis, suggesting that these similarities and expansion of grammar can be attributed to a common "structure of a species-specific program for language, genetically coded and expressed … in the structures and modes of operation of the human brain" (Bickerton, 1984). This hypothesis is based on his claims that several of these shared grammatical features have no antecedent in the pidgin, or the superstrate or substrate languages. Bickerton further claimed that "the effectiveness of transmission of pre-existing languages will vary inversely with the degree to which bioprogram features are able to emerge" (Bickerton, 1984), proposing a "pidginization index" that varies according to shifts in the proportion between slave and master populations, such that a creole with a lower index has had less influence of the superstrate and thus reflects more characteristics of the bioprogram.

Bickerton proposed that the language bioprogram hypothesis suggests that "the infrastructure of language is specified at least as narrowly as Chomsky has claimed" (Bickerton, 1984), referring to the innate specification of UG. More specifically, he employs Chomsky's theory that UG can be defined as a set of parameters each specifying an aspect of grammar, with each parameter having a small number of possible settings such that the possible combinations of these settings give rise to the possible core grammars of human language. Then, "the bioprogram grammar would simply constitute the list of preferred settings that the child, in the absence of contrary evidence, would assume to be appropriate" (Bickerton, 1984). That is, the bioprogram reflects the unmarked values of the various parameters, and can be understood as a more specified theory about S_0.

Subsequent scholars have pointed out that creole genesis and language acquisition occur under different conditions, and thus there is no *a priori* reason to assume that these distinct linguistic environments should relate to the same processes and principles (e.g., Baptista, 2012). Furthermore, the school of emergentism counter-proposed that universal language properties may simply arise from domain-general abilities such as statistical learning and attention, in conjunction with the constraints on human communication frameworks, such as oral and aural physiology, neurophysiology, and social networks, without requiring any innate or specialist module (e.g., Bates et al., 1998). Nonetheless, these ideas reflect a growing interest in the language acquisition and development process, and more specific characterisation of what exactly constitutes "language" as a human capability.

5.5 The evolution of generativism

Chomsky's generativism underwent significant change over the course of the late twentieth century. His initial formulations of transformational grammar relied on specific phrase structure rules and transformations (Chomsky, 1957), but later revisions introduced more abstractions, including the replacement of individual phrase structure rules with X-bar theory, and specific transformations with more general constraints and rules. This generalisation culminated in Government and Binding Theory (GBT) (Chomsky, 1981, 1982), which involves grammatical modules that govern separate aspects of grammaticality. Since the 1990s, Chomsky has turned his focus towards the Minimalist Program (MP) (Chomsky, 1993), which seeks to approach syntax from the "bottom-up" based on the conceptual guideline of "perfection"—i.e., what an optimal theory of I-language *should* look like. Practically, many contemporary Chomskyan generativists still adopt an approach similar to that of GBT, while the MP often focuses on high-level theoretical issues due to its somewhat more austere characterisation of grammar. Chomsky admits that, under the latter paradigm, "virtually every aspect of (I-)language remains a problem" (Chomsky et al., 2019), and generativists thus continue endeavouring to reconcile their toolkit with the available empirical evidence.

5.6 Conclusion

The generativist project brought important scrutiny to the object of linguistic study, and provided a systematic and robust framework for analysing syntax. The generativists' focus on UG in particular introduced novel conceptions on the nature of language and the tools used to study and describe it. In this regard, Chomsky's ideas have been revolutionary in the field of linguistics (Newmeyer, 1986), to the extent that alternative theories often reference his work as a point of departure (Wasow, 2017), and linguistics today continues to be influenced by his ideas regarding competence, nativism, and universality.

6 Universals and variation

6.1 Introduction

The school of generativism adopted a largely rationalist approach to language, basing its concepts and theories on arguments from reason (e.g., the poverty of the stimulus argument leading to the positing of an innate language acquisition device). On the other hand, other fields of linguistic inquiry in the mid-twentieth century adopted a more empiricist approach, focusing on generalisations and conclusions drawn from observed data (Markie & Folescu, 2023). Two such fields that emerged during this period are typology and (variationist) sociolinguistics, and their contributions to linguistics can be understood in terms of how they handled the related concepts of universals and variation.

6.2 Typology: Characterising cross-linguistic variation

Chomsky's conception of generativism meant that it is possible to understand Universal Grammar through studying a single language, and perhaps even a single speaker, since its role is to account for language capability that cannot be explained developmentally by primary linguistic data. On the other hand, typology is fundamentally cross-linguistic and comparative, and attempts to characterise and describe the variation among different languages (Croft, 2017). Furthermore, while the relativistic view proposed by the American structuralists suggested that languages can vary arbitrarily and without limit (Joos, 1957), typology was interesting in studying the constraints on such variation through the systematic analysis of a wide variety of languages.

The typological approach has been a component of comparative linguistics since the latter's emergence; a prominent example is morphological typology (isolating, fusional, agglutinative), first articulated by Schlegel (1808). However, the founder of modern typology is often considered to be Joseph Greenberg, who in 1963 published his now-classic article on the typology of word order (Greenberg, 1963). In this work, Greenberg surveyed 30 languages over many families and geographical areas, including language isolates such as Basque and Burushaski. He then analysed correlations across combinations of features in different languages, and thereby described implicational universals (i.e., of the form "given x, we find y") regarding the order of sets of elements such as subject–verb–object, adjective–noun, and adposition–noun.

Furthermore, Greenberg attempted to explain the nature of such universals by proposing two competing motivations. The first is dominance, which refers to a preference for one order over the other. For example, the verb–object order is dominant over the object–verb order. The second is harmony, which refers to a dependency between particular orders. For example, the adjective–noun order is harmonic with the numeral–noun order. The tension between these two principles can be described as follows: the dominant order can always occur, but the recessive (i.e., non-dominant) order can only occur when a harmonic construction is also present.

Considering different facets of word order, Greenberg identified three main types of languages. Type I has a verb–subject–object order, along with noun–adjective and prepositions. Type II has a subject–verb–object order, along with noun–adjective and prepositions. Type III has a subject–object–verb order, along with adjective–noun and postpositions. The existence of Types I and III demonstrate harmony, while Type II can be explained by the general dominance of noun–adjective. These motivations thus explain why these types are much more common than other possible orderings (e.g., object–subject–verb).

Greenberg's revolution of typology can be characterised by three key contributions (Whaley, 1997). Firstly, Greenberg focused on structures within languages, rather than features of the language "as a whole". This allowed for more fine-grained analyses that were nuanced, rather than discrete but inaccurate categorisations of languages. This in turn meant that Greenberg could make use of systematic quantitative and qualitative methods to study typology, rather than vague and often subjective descriptions and characterisations. Finally, Greenberg's study of a diversity of languages emphasised the importance of eliminating potential genetic or areal biases in the language data when determining typological tendencies cross-linguistically. These principles have informed subsequent typological work, improving the precision of empirical descriptions and the validity of extracted generalisations.

6.3 The contribution of typology

The field of typology has demonstrated an approach that employs both statistical tendencies and logical deduction to describe implicational universals, in opposition to the Chomskyan absolute universals, which by their nature are exceptionless and somewhat more theoretical (since they must be indirectly derived from assertions about language acquisition). Additionally, while Chomskyan universals have their origin in a posited biological language acquisition device, typological universals typically depend on functional explanations (e.g., the principle of economy), thereby relating patterns in variation to underlying cognitive principles and the organisation of knowledge and experience.

Typological work has also been used to support other schools and theories, including generativism itself. One example is Jakobson's later investigation into child language acquisition, in which he claimed that the chronological order of children's acquisition of phonemes aligns with orders of precedence observed in the languages of the world (Jakobson, 1968). For example,

children learn to pronounce stops before fricatives, and similarly, languages that contain fricatives also contain stops. Another example is Keenan and Comrie's study of relative clauses, in which they propose the noun phrase accessibility hierarchy (purported to be a component of Universal Grammar) based on the types of relative clause constructions that occur across various languages (Keenan & Comrie, 1977). In general, implicational and absolute universals can be unified by proposing an underlying hierarchy that holds across languages, such that extant variation must nonetheless conform to the hierarchy.

In a more anthropological dimension, Berlin and Kay conducted a typological study of basic colour terms in 98 languages, finding that there were universal restrictions on the sets of colour terms that can exist in a language, as colour terms were acquired in an ordered, stage-like manner (Berlin & Kay, 1969). This study has inspired much subsequent work on whether colour processing (e.g., perception, memory) is affected by colour terms and categories, thereby contributing to evidence regarding the Whorfian hypothesis (Kay et al., 2010; Kay & Regier, 2006; e.g., **davidoffColourCategoriesStoneage1999?**). The researchers also claim that this hierarchy reflects a cultural evolutionary process, in which languages' systems of colour terms develop over time, thereby connecting the synchrony of implicational universals with the diachrony of language change. More recent work examining the space of attested colour systems has also supported the idea of communicative efficiency—that semantic systems exhibit a trade-off between cognitive cost (the size of the system) and communicative cost (the specificity of the system), with real systems lying close to the optimal frontier (Kemp et al., 2018).

In general, typology has demonstrated that variation across languages can be studied systematically, rather than being arbitrary and unconstrained. It is also interesting to note that many implicational universals have been observed and described, while the set of accepted absolute universals remains relatively small (or indeed nonexistent) (Croft, 2017). This may prompt a rethinking of the notion of "language universals", and indeed the conception of "universal grammar" itself.

6.4 Variationism: Characterising intra-linguistic variation

Another aspect of the generativist project is its rejection of language use as an object of study, in favour of the structural essence of the language. This can be seen in Chomsky's distinction between I-language and E-language, or between competence and performance, and has its roots in the Saussurean *langue* vs *parole*. The Chomskyan notion of I-language also meant that investigations into the structure of language are necessarily individual—no two humans share the same I-language, and the differences between particular I-languages are due to idiosyncrasies in the primary linguistic data received during the language acquisition period. (In practice, many generativists characterise "language" as being sufficiently similar across individuals within the same speech community to permit coherent study; see Chomsky, 2015.) In contrast, the variationist school focused on language in terms of its social communicative

function, and suggested that variation in language is systematic and analysable (rather than chaotic and random), drawing from earlier work in dialectology and sociology.

Early ideas regarding sociolinguistics arose around the turn of the twentieth century, such as in the work of Gauchat (1905). Nonetheless, modern sociolinguistics only became established through the work of William Labov, beginning with his seminal study in Martha's Vineyard, an island in Massachusetts (Labov, 1963). In this work, he introduced the notion of the linguistic variable, which is a feature of language that varies across speakers. When such variables are frequent, stratified, and salient, but immune from conscious distortion, they serve as a useful source to investigate sociolinguistic variation. In particular, the Martha's Vineyard study found that islanders' resistance to the ways of the mainland was reflected in the preservation of variables that were more archaic, on the basis of data related to islanders' social position, opinions, and linguistic production.

Labov's study demonstrated that variation among speakers was neither random nor free; instead, the distribution of variants was systematic and constrained by social factors. Furthermore, he proposed that synchronic variation could be seen as a snapshot of diachronic change, thereby suggesting that language change is observable. Subsequent work by Labov further refined the methodology for sociolinguistic data collection: for example, varying the topic and style of an interview could elicit different registers within the same speaker (Labov, 1966), and the pressures related to an interview setting could also be reduced by conducting group interviews (with family or peers) (Labov et al., 1968), or by adopting elicitation techniques without explicit observation (Labov, 1972b). These studies helped to clarify the role of context in sociolinguistic variation, and also provided useful techniques to minimise such effects when studying other sociological variables.

6.5 The contribution of variationism

The pioneering work of Labov and other sociolinguistics scholars demonstrated that language variation is structured and orderly, and reflects inherent variability in a grammatical system rather than randomness (Weinrich et al., 1968). This opposed contemporary views that attempted to eliminate real-world variability in order to study the abstract object of language. The import of methodological approaches from other social sciences also helped to provide this field with quantitative tools to analyse empirical data probabilistically and in detail, while generativism tended to be more theoretical, deterministic, and general.

Variationism also contributed ideas relating to the field of historical linguistics. The study of age-graded variation has led to ideas such as the apparent-time hypothesis, which suggests that language change can be studied by comparing the language use of speakers of different ages, under the assumption that differences among different generations of speakers reflect diachronic developments in the language (Bailey, 2002). Variationist sociolinguistics has also been used to support the wave–diffusion model of language change (Trudgill, 1974). Effectively, the notion that variation and change are two sides of the same coin promoted the reintegration

of synchrony and diachrony, and provided a new methodology for the study of language change as it is occurring.

Another finding of variationism is that language variation is normal and universal. As a result, variationists have also been strong proponents for correcting stereotypical beliefs about stigmatised dialects (Charity, 2008). Labov's own work was also motivated by an attempt to dispel incorrect notions about African-American Vernacular English, demonstrating that this dialect is indeed structured and rule-governed, rather than being a deficient form of English (e.g., Labov et al., 1968; Labov, 1972a). This perspective has prompted changes in language education pedagogy (Charity-Hudley & Mallinson, 2013) and has helped to shape the conversation around language abilities, particularly with regard to standard languages (Reaser et al., 2017). Later waves of sociolinguistics have also considered the role of more local social dynamics as well as the use of variation to index identities and social positions, bringing speakers' agency to the fore as an important force driving language variation (Bell, 2016; Eckert, 2012).

6.6 Conclusion

The middle to late twentieth century saw the rise of a multitude of approaches towards variation. For the generativists, variation was relevant only insofar as it demonstrated the range of possible I-languages that universal grammar needed to account for. However, alternative approaches considered such variation to be orderly and systematic. Typology attempted to understand cross-linguistic variation by describing the nature of such variation and the constraints that it obeyed, while variationism attempted to understand intra-linguistic variation by examining sociological factors affecting the distribution of variables among speakers and settings. The variety in perspectives has resulted in a broad range of results pertaining to language, giving a more holistic account of the unity and diversity of language.

7 Meaning and function

7.1 Introduction

The Saussurean sign is composed of a form and a meaning, and implies that linguistics should concern itself with both. However, much of linguistics prior to the 1970s had focused on the structure of language and avoided the study of meaning, either because meaning was unstructured and unamenable to methodical study (e.g., Chomsky, 1957), or because it was not central to the object of linguistic study (e.g., Chomsky, 2012). Conversely, it was philosophers who were first interested in meaning, truth, and language, and the linguistic turn around the end of the nineteenth century resulted in the formalisation of concepts related to meaning. Key philosophers in this field include Frege, who suggested that truth is fundamental to the meaning of a sentence via reference (Frege, 1879); Wittgenstein, who formalised truth-conditional semantics (the idea that the meaning of a sentence is exactly or reducible to its truth conditions; Wittgenstein, 1921); and Carnap, who clarified the distinction between extensions (truth-value of a sentence or referent of a name) and intensions (functions from indices, or context markers, to extensions; Carnap, 1942). Nonetheless, these philosophers' works were largely couched in artificial languages, resulting in a lack of interest among linguisticians (Chomsky, 1955).

7.2 Formal semantics

A critical development, however, came from the work of Montague, which can arguably be construed as the origins of formal semantics proper. Building on the idea of a homeomorphism (i.e., structure-preserving mapping) between syntax and semantics, Montague suggested that each syntactic rule (regarding constituent combination) had an associated semantic rule, which would specify how the meaning of the whole was formed from the meanings of the parts (Montague, 1973). He formalised this using typed intensional logic, in which categories of constituents are expressed in terms of combinations of entity expressions (i.e., expressions for an individual; denoted e) and truth-value expressions (i.e., declarative sentences; denoted t). For example, sentences are type t, and nouns are type e, thus intransitive verbs (which take a single noun as the sole argument) must be type $<e\ t>$—objects that, when combined with one of type e, returns an object of type t. This system, later dubbed Montague grammar by Partee (1975), could explain a variety of semantic phenomena in English, including transitive verbs, verbs of propositional attitude, and modal expressions. This supported Montague's thesis that natural and formal languages could be treated similarly and could undergo similar analyses.

Following Montague, a robust cooperation between philosophy and linguistics began, thereby developing the field of formal semantics. This area of research includes further work on truth-conditional semantics: for example, Lewis demonstrated that possible-worlds semantics (that the intension of a sentence is a function from a possible world to a truth-value) was a viable framework for understanding natural language (Lewis, 1970). Another overlapping area of interest is reference, which is concerned with the relationships between signs and their referents; common topics in this issue include proper names, indexicals, and definite descriptions. Several models of reference have thus been proposed, including the descriptivist view, proposing that reference occurs through the specific descriptive content associated with the sign, with proponents such as Russell (1905). In contrast, Kripke introduced a theory about how linguistic forms come to be associated with their referents—linked to an original act of naming via a causal chain (Kripke, 1980). These concepts provided a theoretical framework to ground abstract linguistic meaning in objects, and brought clarity into the study of meaning by introducing logic-based techniques and vocabulary.

Another field of investigation relates to the nature and structure of the conceptual space. This includes lexical semantics, which is interested in the meaning of lexical units, including their classification and decomposition. For example, Jackendoff proposed a componential approach towards semantics, which decomposes the concept of a lexical entry into abstract conceptual primitives (e.g., *wife* > [+female] [+adult] [+human] [+married]; Jackendoff, 1976). Other topics include lexical relations (semantic relationships between different lexical units; Fellbaum, 2015) and semantic field theory (organisation of concepts into domains; e.g., Lyons, 1977). The work in this area thus demonstrated that meaning can be conceptualised as structured and analysable, rather than amorphous and unintelligible.

The development of a systematic, compositional, and robust semantics also affected its sister field of syntax. Part of the impetus for transformational grammar is the observation that certain correspondences between structures are essentially meaning-preserving (e.g., passivisation), suggesting that there may be some common "deep" or "base" form from with both are obtainable as variant surface forms. However, Partee has observed that "with a real semantics, we don't need sameness at any syntactic level … to capture sameness of meaning"; more generally, she noted that "once we have a semantics that can do some real work, then syntax doesn't have to try to solve problems that may be semantic in nature" (Partee, 2014). Such a "division of labour" has thus given rise to a number of other grammatical frameworks that do not posit transformations, including Lexical-Functional Grammar (Dalrymple et al., 2019; Kaplan & Bresnan, 1982) and Head-driven Phrase Structure Grammar (Müller et al., 2024; **pollardInformationbasedSyntaxSemantics1987?**), in which semantics is handled by separate representations or formalisations (e.g., Glue semantics; Dalrymple et al., 1993).

7.3 Pragmatics and discourse analysis: Language in use

Despite the advances made by formal semanticists, some scholars remained unconvinced of its applicability given the (ostensible) inaccuracies in the mapping between the compositional semantics of a sentence and its understood 'meaning' (in the pre-theoretic sense) by language users. In this regard, Grice was particularly instrumental in bridging the gap between formalists (who advocated the use of formal language for its unambiguity and precision) and informalists (who were concerned about actual uses of natural language); he suggested instead that "the common assumption of the contestants that the divergences do in fact exist is (broadly speaking) a common mistake, and that the mistake arises from an inadequate attention to the nature and importance of the conditions governing conversation" (Grice, 1975). He thus introduced the notion of implicature, which refers to the act of implying something without it being either explicitly expressed or directly inferable from the content of the utterance. Implicature related to features of discourse (i.e., conversational implicature) arises from the tacit assumption that participants in a conversation are cooperative, and thus apparent deviances from cooperativity can be exploited to convey additional implicated meanings (in the absence of uncooperative behaviour such as lying, or explicit opting out of some aspect of cooperativity). A more recent extension of the cooperativity principle is the Rational Speech Act model (Frank & Goodman, 2012), which explicitly formalised the speaker's mental simulation of their interlocuter's interpretation of possible utterances, such that speakers choose the utterance that best communicates their intended meaning. This approach has allowed for more quantitative modelling of language use to account for a range of phenomena including metaphor (Kao et al., 2014) and politeness (Yoon et al., 2016). This analysis of meaning in embodied utterances became a foundation of the field of pragmatics, the study of the communicative function of language.

The other foundational component of pragmatics is speech-act theory, expounded by Austin (Austin, 1962) and Searle (J. Searle, 1969). This theory suggests that performative utterances can be analysed in three levels: the locutionary act (the actual utterance and its content), the illocutionary act (the intended result of making an utterance, e.g., promising, threatening, requesting), and the perlocutionary act (the actual effect of making an utterance, e.g., someone else performing an action). The fact that such actions are not truth-valuable means that they do not lie within the domain of semantics, but it seems that they are nonetheless central to the function of language as communication. Ongoing research continues into the conditions and interpretations for performative utterances in linguistics and philosophy (e.g., Condoravdi & Lauer, 2012; Green, 2021; Kamp, 1978), as well as in the realm of legal interpretation (e.g., Cao, 2007).

Another facet of such a functional approach is the acknowledgement that language use does not employ isolated sentences, but strings of sentences, non-sentence strings, discourse markers, and other elements that together form a conversation. This observation leads to the subfield known as discourse analysis, which is concerned with the contexts, structures, and processes related to linguistic units larger than individual sentences. An important early scholar in this

field is Hymes, who proposed the notion of communicative competence (Hymes, 1962), referring to the knowledge a speaker must possess to appropriately use language in social contexts (i.e., relating to conventions about language use). Communicative competence involves aspects of communication such as turn-taking, participant relationships, and discourse genres, all of which affect the form and nature of the linguistic interaction. Such factors also affect the meaning of component utterances within the discourse; Lewis thus suggested that conversation can be considered a sort of language game, such that "[s]entences depend for their truth value, or for their acceptability in other respects, on the components of conversational score at the stage of conversation when they are uttered" (Lewis, 1979).

As such, deriving the actual meaning of an incarnated utterance depends on pragmatic and discourse factors, demonstrating the need for analyses of such factors to understand actual language use. In fact, pragmatic and discourse functions also affect the syntactic structure of sentences via informational structure (e.g., topic and focus) (e.g., Roberts, 2012). These phenomena highlight the fact that there may not be a hard distinction between semantics proper and either pragmatics or discourse (e.g., Bach, 2003), and indeed some extreme functionalists believe that all meaning is context (e.g., Hopper, 1987). More generally, these fields focus on the communicative function of language, and thereby fall under the umbrella of functional linguistics, in contrast with the structure-emphasising formal linguistics (Van Valin, 2017).

7.4 Cognitive linguistics: The linguistics wars and beyond

As interest in the study of meaning grew, a group of Chomsky's colleagues and students began work in generative semantics, which aimed to understand meaning from a generativist point of view. They began with the Katz–Postal hypothesis (Katz & Postal, 1964), which suggests that transformations are meaning-preserving; taking this to its logical conclusions, it implied that language has a core component in which syntax and semantics are closely interrelated. This proposition contrasted with Chomsky's own position, which supported the autonomy of syntax, suggesting instead that syntax is the sole generative component in language, and that semantics is only applied once syntactic structures have been formed (see Jackendoff, 1972). The disagreement between these two factions became known as the linguistic wars, which was a protracted dispute that was not just conceptual but also rhetorical and academic in nature (R. A. Harris, 1995).

Eventually, the logical consequences of generative semantics meant that it became distinctly *not* generativist in flavour—for example, Lakoff and Ross questioned the need for a deep structure altogether (Lakoff & Ross, 1976). The group thus disbanded, with its members pursuing different—albeit all non-Chomskyan—frameworks for understanding language. One important school that emerged is cognitive linguistics, which (contra Chomsky) suggested that language relies on general cognitive processes and principles, rather than being an autonomous and independently organised unit in the brain (Croft & Cruse, 2004). The form of language, then, follows from its function (rather than being independent of it).

Cognitive linguistics has thus been influenced by cognitive psychological ideas regarding conceptual organisation, including polysemy, categorisation, prototype theory, and metaphor. This last notion refers not just to linguistic metaphors, but conceptual metaphors—the use of one domain to represent another typically more abstract domain as a mode of thought (Lakoff & Johnson, 1980). Lakoff and Johnson proposed that this principle is supported by image schemata, which are cognitive structures that enable abstract reasoning by identifying recurring patterns (e.g., the schema of "containment," which is employed in spatial senses of the English word *out*; Johnson, 1987). Metaphors can thus exploit such schemata for other concepts (e.g., non-spatial senses of *out*, as in *leave out*).

Such conceptual structures are also relevant to linguistic forms, which are symbolically linked to these meanings (Langacker, 1991). Under the cognitivist notion that form reflects function, semantics is linked not only to lexical items, but also to grammatical arrangements (recalling earlier work by Bloomfield and Pike). This proposal is the premise of construction grammar, which suggests that language comprises constructions (i.e., pairings of form and meaning; see e.g., Fried & Nikiforidou, 2025; Hoffmann & Trousdale, 2013; Lakoff, 1977). Constructions arise whenever some aspect of its form or meaning is non-compositional, including not only morphemes and words, but also multi-word expressions (e.g., *jog X's memory*), idioms, and abstract grammatical "rules" such as passive voice. For example, a key early paper explored the interaction between idiomaticity and productivity in the English phrase *let alone* (Fillmore et al., 1988). As a result, under this framework, there is no strict distinction between syntax and lexicon, and semantics is inextricably linked with morphology and syntax. Such a cognitive approach thus provides a paradigm that is radically different from Chomskyan generativism, and continues to evolve in tandem with developments in cognitive psychology.

7.5 Conclusion

Investigations into meaning from the late twentieth century onwards have demonstrated that meaning is systematic and structured, and is an important part in language. The relationship between meaning and the communicative function of linguistics has also led to the development of functional linguistics, providing an alternative to more formal approaches. These efforts have also highlighted the importance of interdisciplinary scholarship, as insights from philosophy and psychology have resulted in entirely novel paradigms in linguistics. In summary, these developments have helped to bridge the abstract structures of language and its real-world use, permitting a richer conception of linguistic signs.

8 Computational approaches

8.1 Introduction

One of the more recent perspectives on language has viewed it as information. This treatment arose initially from the field of information theory (Shannon, 1948), which used a mathematical lens to view communication as a means of sending information from a sender to a receiver, subject to constraints on the communication system (e.g., its channel capacity or noise). More broadly, the application of computational approaches to linguistics has seen an exponential growth in interest in the last half-century, from early efforts in machine translation for military intelligence applications (Hutchins, 1999) to recent sophisticated chatbots (Open AI, 2024). Much has been written elsewhere on the history of computational linguistics and natural language processing (e.g., Johri et al., 2021; K. S. Jones, 1994; Schubert, 2020); here we focus on surveying some theoretical and philosophical issues regarding such approaches.

8.2 Why computational modelling?

Computational approaches afford a few particular advantages given the methods used to construct, fit, and employ computational models. The first is *formalisation*: since computational models require the operationalisation of constructs related to language, they require an explicit quantification of language how it is processed and/or acquired, rather than relying on verbal theory. Such formalisation is useful because it allows for the instantiation and evaluation of proposed mechanisms of language processing and acquisition, demonstrating how these mechanisms can (or cannot) explain the observed variation in actual human language. For example, computational models have been used to explain how humans handle communication in settings with noise or errors (Gibson et al., 2013; Levy, 2008), how children acquire regular and irregular past tense forms in English (Plunkett & Juola, 1999; Rumelhart & McClelland, 1987), and how unexpected words slow down reading speed (Oh & Schuler, 2023; E. G. Wilcox et al., 2023). By investiating input–output correspondences in these computational models, linguisticians can validate theories of language use, but also conduct experiments that may not be possible on humans (e.g., controlled rearing studies, Christiansen & Chater, 1999), or search through a larger parameter space for optimal experiment design (Huan et al., 2024).

Another benefit of computational approaches is the ability to handle *large volumes of data*. Continued advancements in corpus collection has vastly increased the amount of available

language data (e.g., Common Crawl, 2025), which would be intractable to manually annotate. The use of computational models allows for the automatic processing and annotation of such data (e.g., Qi et al., 2020; Straka et al., 2016), permitting much larger-scale analyses and possibly the detection of lower-frequency constructions or phenomena with smaller effect sizes, which may not have otherwise appeared in smaller datasets (e.g., Roland et al., 2007).

A third contribution of computational methods is that they can represent the *rich, high-dimensional nature of language*. One significant advance is the shift towards sub-symbolic representations of language, especially distributional semantics, which suggests that word meanings can be elucidated from the contexts in which that word appears (Firth, 1957). Hence, word meanings can be represented as vectors or embeddings, which capture statistical patterns of the contexts in which the word occurs (e.g., Mikolov et al., 2013); this approach stands in stark contrast with formal symbolic theories of semantics, in which it is difficult to express a comprehensive description of meaning that can account for the entire lexicon. The distributed representations of meanings allows them to be arbitrarily composed mathematically, and can also serve as numerical representations for other kinds of operations (including those in modern neural network models). Furthermore, embeddings appear to have properties which align with humans' linguistic representations (Grand et al., 2022), suggesting that they do in fact capture relevant dimensions of variance in semantics. We can also probe the internal representations of language models to determine how much semantic information is accessible from purely linguistic information—for example, it is possible to read out human colour perceptions (Marjieh et al., 2024) and cyclic representations of time (Engels et al., 2024) as emergent properties of language model representations.

Broadly, the quantitative nature of computational methods has enabled mechanistic, large-scale, robust, and sophisticated analyses of language that would be difficult to conduct otherwise. It is important to note that these characteristics may not apply to every computational approach—for example, modern language models are often difficult to interpret mechanistically (but see Rai et al., 2024). Nonetheless, these tools have provided us with new insights into the structure and usage of language.

8.3 The push towards language modelling

We can also approach the question of computational linguistics from the opposite angle: What makes language a good target for computational approaches? Some possible responses are clear, including the fact that language is essential for human communication, and that it is ubiquitous and thus has a large quantity of potentially available data. There are several other features that make language learning an interesting problem for computational approaches. First, it appears to be effectively universal across humans (barring developmental difficulties), and learnt early and without much explicit instruction—recall that these are the same arguments initially used to support Universal Grammar. That language is so pervasive is a good indicator that progress in machine use of language would be very useful for many applications.

On the other hand, language appears to be difficult to learn and represent from a formal perspective. For example, early research into machine translation quickly revealed that it is not as straightforward as had been assumed, particularly due to non-linearities in the information (e.g., hierarchical grammatical structure, differing categorisations of semantic space, and information structure); thus, early symbolic approaches were relatively limited in what they could accomplish (e.g., Weizenbaum, 1966). Hence, natural language processing has emerged as an important challenge task for computational approaches.

Progress in language modelling has often been driven by difficult aspects of language representation and usage. For example, the streamed, linear format of language contrasts with the static, single-snapshot format of vision or other modalities of data; as such, handling complex time series information is necessary for language modelling, and drove early neural network approaches for handling dynamic data, including recursive neural networks (e.g., Costa et al., 2003). Language also exhibits long-distance dependencies (whether the narrowly-defined grammatical phenomenon, or more general informational dependencies), which was one of the impetuses for the development of attentional mechanisms, such that computations involving later words can "attend" more or less to earlier words depending on relevance (Vaswani et al., 2023). More recent approaches have also emphasised the importance of multimodal grounding in semantics and natural language understanding (Radford et al., 2021), as well as the distinction between truthfulness and usefulness in language use (Ouyang et al., 2022).

Furthermore, the modelling of "language" in fact encompasses a very large range of phenomena and capacities. These phenomena include traditional topics in linguistic analyses, including grammatical parsing (e.g., Bai et al., 2023; Vinyals et al., 2015), reference resolution (e.g., Moniz et al., 2024), natural language inference (e.g., Gubelmann et al., 2024), language acquisition (e.g., Elman, 1993; Wang et al., 2023), and the distinction between formal and functional competence (e.g., Mahowald et al., 2024). Computational approaches to language have also addressed issues related to different modalities of language data, including speech recognition (e.g., Dahl et al., 2012; Radford et al., 2022) and optical character recognition (e.g., Poznanski et al., 2025), or even further afield to decoding neural representations of language (e.g., Défossez et al., 2023; Hong et al., 2024). The diversity of potential target phenomena have driven a corresponding expansion in the methods and techniques employed under the broad umbrellas of computational linguistics and natural language processing, and continue to encourage innovation in contemporary computational approaches.

8.4 Philosophical issues in computational linguistics

The computational modelling of language has always been associated with corresponding philosophical issues related to these models. Turing famously introduced the idea of the Turing test, which suggests that a machine can be considered intelligent if a human interrogator is unable to distinguish between it and another human (Turing, 1950). This test is also related to Searle's Chinese room thought experiment (J. R. Searle, 1980), which (contra Turing) suggests

that it is possible for a person in a room to follow a set of instructions for constructing appropriate responses to inputs given in Chinese, even if they do not understand Chinese themself. Hence, the Turing test is too crude to determine understanding. These arguments have been naturally extended to modern large language models (LLMs), which do exhibit language performance sophisticated enough to ostensibly pass some Turing tests (C. R. Jones & Bergen, 2024).

Linguisticians have taken up a very broad range of perspectives on the modern version of this debate—that is, whether LLMs can tell us anything about linguistics. Some researchers believe that they cannot, largely because the context in which LLMs learn and use language is qualitatively different from humans, who use different mechanisms for learning, have much less input data, and are embodied in a multisensory, social environment that drives true meaning-making (e.g., Bender et al., 2021; Bender & Koller, 2020; Bolhuis et al., 2024; Gomes, 2024; Kodner et al., 2023). Under this view, the inherent differences between human and machine learning imply that language models cannot truly serve as effective models of language learning and use. However, a key under-addressed issue is the validity of the assumptions made—for example, do models in fact require human-like learning mechanisms in order to be effective models of language? Given that modern LLMs do show relatively sophisticated language behaviour, it seems plausible to posit that even "unnatural" learning mechanisms can extract meaningful structural features of language, such that these models remain interesting artifacts for investigation, especially since they permit analyses that would not be possible with humans.

A much more bullish perspective on LLMs is that they can themselves serve as theories of language, which may even surpass traditional linguistic theories, since they provide more accurate predictions about language behaviour in humans (e.g., Baroni, 2022; Piantadosi, 2024). While LLMs do indeed have increasingly strong predictive power, they lack explanatory power, since they only provide descriptions either at a very high, abstract level (e.g., regarding phenomena), or at a very low, implementational level (e.g., regarding statistical learning), neither of which are useful in providing interpretable, analytical explanations of linguistic phenomena (see Opitz et al., 2025).

In contrast with both of these more extreme perspectives, a growing group of researchers have laid out something of a *via media*: language models can serve as interesting ways to probe and evaluate linguistic theories, even if they do not serve as complete theories themselves (e.g., Binz et al., 2025; Frank & Goodman, 2025; Futrell & Mahowald, 2025; Mansfield & Wilcox, 2025; Millière, 2024; Pater, 2019; Portelance & Jasbi, 2024). Two ideas are key in this regard. The first is *representations*: probing the internal representations of LLMs allows us to understand what kinds of representations are able to support complex language behaviour (see Tosato et al., 2024). For example, language models appear to encode hierarchical syntactic information (Rogers et al., 2020) as well as syntactic relations (Diego-Simón et al., 2024), suggesting that such representations are important for appropriate language production, as opposed to merely operating over linear positional features. Another key idea is *learnability*: understanding what can be acquired by language models reflects the inductive biases that

may or may not be necessary for language learning in humans. A recent line of work has demonstrated that actual human languages are easier for LLMs to learn than implausible languages (e.g., with inconsistent word order; Kallini et al., 2024; Xu et al., 2025; Yang et al., 2025), refuting the supposition that language models are able to learn any arbitrary language (Moro et al., 2023), and conversely suggesting that structural regularities in the input are crucial for a language to be learnable—even for learning algorithms like statistical learning. This moderate perspective draws connections among symbolic linguistic theory, information theory, and language modelling, allowing for more multifaceted approaches toward understanding language.

8.5 Conclusion

Computational approaches have received a lot of attention in recent years, and much debate continues on their application and implications for linguistics. Nonetheless, it is exciting that these approaches have permitted many analyses which were hitherto impossible, and it will be interesting to observe how this young field continues to develop and mature over time, through both technical and methodological improvements, as well as continued theoretical and philosophical discussion.

9 Linguistics in the 21st century

9.1 Introduction

As linguistics has developed in sophistication, it has also grown in breadth, and a more expansive set of methodologies have arisen as a result of investigation into increasingly diverse facets of the phenomenon of language. This trend has continued through the end of the twentieth century and into the beginning of the twenty-first. Many directions in linguistics research have emerged and grown as a result of broadening sources of data, an increasing emphasis on empiricism, and further applications of linguistics.

9.2 Broader sources of language data

It is interesting to note that linguistics has yet to exhaust all potential sources of data. Some such data come from languages or dialects that have only been recently documented, or from new archaeological evidence regarding historical language forms. The advent of technologies such as voice and video recording and online information sharing has also enabled linguisticians to work on high-quality raw data even if they are not personally collecting such data in the field.

A particularly noteworthy source of language data is from sign languages. Historically, these were often considered to be inferior to spoken or written language, resulting in little work in data collection and analysis. Gradually, serious investigation into sign languages resulted in the observation that they are as robust, complex, and productive as spoken languages (Klima & Bellugi, 1979). Subsequent sign language linguistics has demonstrated that sign languages share many characteristics of spoken language, including multiple levels of organization (Stokoe, 1960), arbitrariness of signs (Johnston, 1989), prosodic information (Wilber, 2000), and a critical age for learning (Mayberry, 1998). However, there are also ways in which sign languages raise unique and important questions in linguistics. For example, sign languages seem to exhibit grammatical similarities that are as yet unexplainable (since many of them have developed independently) and simultaneously not shared by spoken languages (Sandler & Lillo-Martin, 2017); this finding may provide insight into the role of iconicity in language, as well as the nature of Universal Grammar. The notion of sign space and how it is used is also particularly interesting, since the manual modality permits simultaneity and motion dynamics to a much greater degree than spoken languages (e.g., Perniss, 2020; S. Wilcox &

Martínez, 2020). Furthermore, new sign languages continue to appear in isolated village populations (Meir et al., 2010), providing case studies for investigations into language origins and development. Particularly interesting is Nicaraguan Sign Language, which emerged largely spontaneously among Nicaraguan deaf students in the 1980s (Senghas et al., 2005). More generally, the study of sign language provides linguisticians with an opportunity to study universal properties of language that are not dependent on the modality of transmission.

Another emerging source of novel language data is the Internet, and this medium has brought a variety of new perspectives in linguistics (Crystal, 2005). In particular, the Internet has introduced large-scale near-instantaneous connectivity among many spatially disparate groups of people, resulting in a host of phenomena specific to the Internet, including medium-specific codeswitching and multilingualism, rapid language change, Internet lingo and subculture jargon, stylistic diffusion, and metalinguistics around online language use (Androutsopoulos, 2011; Gawne & Vaughan, 2012; e.g., Thurlow, 2001). The variety of communication platforms (text messaging, online chat, social media, emails, blogs) has also resulted in varied and nuanced stylistics in different contexts (Crystal, 2011). Additionally, the ability to transmit more than pure text has resulted in new modes of communication such as typography, emoji, and memes, each with their own conventions and grammars (McCulloch, 2019). The accessibility of the Internet also means that such data are usable for large-scale corpus analyses, and can be studied in real time. These characteristics make Internet linguistics a promising direction for language research.

These novel types of language data thus provide an interesting contrast to current sources, and can thereby bring a new perspective to critical issues about the nature and use of language. In conjunction with greater quantities of language data (in well-documented and parsed corpora) and better qualities of language data (through improved recording techniques), such data permit linguisticians to conduct more thorough and comprehensive analyses to understand general language processes and phenomena.

9.3 Increasing empiricism

One significant contribution of the cognitive turn is the expansion of descriptive linguistics, since putative features of Universal Grammar have to (by definition) account for features of all extant human languages (Baker, 2021). This push toward data collection and analysis has continued and expanded beyond the generative tradition, resulting in an emerging set of methods that aim to ground linguistics in more quantitative metrics, as opposed to the qualitative descriptions that have typically undergirded formal linguistics. Some such methods include formal acceptability judgements, corpus analysis, and psycho- and neurolinguistics.

Acceptability judgements have formed an important bedrock for theoretical linguistics. However, these judgements have typically been informal in nature, originating either in the linguistician's own introspection or through informal elicitation from a small number of informants; as such, they are susceptible to various biases and measurement errors (Juzek, 2015). Instead,

such acceptability judgements can be formalised through the collection of explicit ratings from a larger group of informants that can be aggregated to reduce noise in the measurement (Myers, 2017; Sprouse, 2018). Studies using formal acceptability judgements have allowed for the discovery of subtler effects that may not have been found with more informal judgements (Myers, 2017), and have even challenged previous grammaticality claims (Linzen & Oseki, 2018). Crucially, formal acceptability judgements have highlighted the gradient nature of acceptability, rather than the binary notion of grammaticality typically assumed in theoretical linguistics (Juzek, 2015; Sprouse, 2007). This gradience is challenging for many theories of phonology, morphology, and syntax, and has encouraged the investigation of more probabilistic approaches toward grammar (e.g., Boersma & Hayes, 2001; Lau et al., 2017). More recently, data from formal acceptability judgements have also permitted finer-grained evaluations of computational models of language (e.g., Juzek, 2024; Tjuatja et al., 2024). This approach is limited by the fact that researchers have to pre-select items to test, and have to gather more informants; as such, it is more difficult to conduct formal judgements in field contexts where prior linguistic information and access to informants are less available. Nonetheless, formal acceptability judgements have been increasingly viewed as a key source of quantitative, psychometrically valid data, and their application across a greater range of languages will help linguisticians better understand nuances of grammaticality and acceptability.

Another way to investigate language users' intuitions about language is to directly analyse their productions. This approach avoids issues with language users having to use metalinguistic judgement (e.g., that acceptability judgements reflect norms; Haspelmath, 2020). Corpus analysis adopts this perspective to study distributional statistics across large bodies of collected text that reflect actual language use (Biber, 2006), which may include language of various origins (e.g., books, transcribed speech, web text; O'Keeffe & McCarthy, 2010). Corpora allow for linguisticians to estimate the frequencies of occurrences or co-occurrences of different linguistic elements (Gries, 2009); the particular advantage of having large corpora is that it allows for the detection of low frequency constructions, as well as the comparison of the relative frequencies of different constructions (e.g., alternative forms). Corpus analysis has also supported functionalist linguistics, particularly in investigations of possible functional explanations (e.g., semantics) for the observed variation in forms (McEnery & Hardie, 2013). New and developing methods for data collection (e.g., web scraping; M. Davies, 2016–) and data annotation (e.g., Qi et al., 2020; Straka et al., 2016) will enable more sophisticated analyses over larger and more representative amounts of data, although work is still needed to diversify the languages and populations captured by such corpora (see Dunn & Adams, 2019).

A third source of quantitative data about language use comes from the field of psycholinguistics and its sister field of neurolinguistics. These fields focus on the actual processing of language, and thus need to account for performance factors. Hence, psycholinguistics is concerned with issues such as language acquisition, language production, and language comprehension. This has resulted in a variety of methodological innovations, such as artificial language paradigms to investigate statistical learning (Saffran et al., 1996), priming and prediction to investigate top-down processing (Altmann & Kamide, 1999), lexical decision tasks to investigate lexi-

cal access (Fischler, 1977), and structural ambiguity to investigate online syntactic parsing (Frazier, 1978). Developmental linguistics has also drawn from experimental paradigms from developmental psychology, including paradigms that use looking time as a measure of attention (and thus novelty or familiarity) (Kuhl, 2004). Such research has also been supplemented with neurophysiological techniques, such as deficit–lesion correlation studies in language disorders (Geshwind, 1965; Luria, 1970), and functional neuroimaging to study the spatial and temporal organisation of language processing in the brain (Fedorenko et al., 2024; Frederici, 2002; Gwilliams et al., 2024; Hickok & Poeppel, 2007; Kutas & Hillyard, 1984; Shain, 2021). These techniques have illuminated the cognitive and neural mechanisms supporting language functions in language users, which also in turn constrain plausible theories of language.

Data from judgements, productions, and experiments have thus enriched the body of evidence that can be used to assess linguistic theory. The increasing emphasis on grounded, data-driven linguistics also represents a shift away from the more rationalist approach of early generativism (McEnery & Hardie, 2013)—a greater concern for language as it is actually used, as opposed to an idealised, abstracted notion of language. The expansion of techniques also allows for more multifaceted methodologies that aim toward convergent evidence, ensuring that linguistic theories are more robust and sophisticated.

9.4 Further applications of linguistics

Applied linguistics is an interdisciplinary domain aiming to mediate between theory and practice to address problems related to language (Buckingham & Eskey, 1980). Thus, applied linguisticians consider not only language and its use, but also contexts, social institutions, cultures, and worldviews regarding language (Rees-Miller, 2001). Clearly, there are many potential subfields that may fall within this domain, and it will only be possible to present a cursory overview of some of these research directions.

The earliest subfield characterised as applied linguistics is that of language teaching, typically as related to second language acquisition (since first languages are acquired naturally without little explicit instruction). A particularly important model (which remains dominant today) is communicative language teaching, which conceptualises language not just as an individual's cognitive skill, but as a communicative system that relies on social use (recalling functionalism and Hymes' notion of communicative competence; Sauvignon, 2001). This suggests that students learn language best through interaction, which can be implemented in the form of experiential activities and tasks requiring language use for a communicative purpose (Norris, 2011); as such, classes make use of authentic texts (i.e., not designed specifically for non-native speakers), and the target language is used almost exclusively. An important theoretical idea in this regard is that of comprehensible input, or input that is slightly above learners' abilities but is nonetheless understandable (Krashen & Terrell, 1988). These concepts have resulted in more robust, integrative, and relevant language pedagogies, although there remain important questions about the need for direct grammar instruction and the efficacy of specific curricula.

Another application of linguistics relates to language planning and policy, which is concerned with efforts to modify language practices and beliefs within a community (Spolsky, 2012). Within this field, there are three key areas, namely status planning (about uses of language, e.g., national and official languages), corpus planning (about language itself, e.g., orthographic standardisation), and acquisition planning (about users of language, e.g., education policies; Cooper, 1989). While earlier research in this field focused on issues around language policy in newly independent post-colonial countries, later work began focusing on broader and more general issues, particularly drawing from critical theory (Tollefson, 2016). This latter approach considers the social, economic, and political effects of language planning, such as the linguistic imperialism of using English as a lingua franca (Linguistic Society of America, 2025; Phillipson, 1992) and the inequalities related to indigenous language revitalisation (Coronel-Molina & McCarty, 2016; Duchêne & Heller, 2007). This field has helped to shape and inform language planning both from the top-down and the bottom-up, especially in areas with language minorities, and has also pushed for greater scrutiny on how the various levels of implementation of language policy affect the broader social environment.

Other applied fields include clinical linguistics (related to speech–language pathology and therapy; Crystal, 1981), legal linguistics (related to language use in written law, legal processes, and forensic evidence; Durant & Leung, 2015), and translation (Baker, 1997). Given that language is employed in communications across effectively all domains, it is unsurprising that such a range of applications is possible, and indeed will continue to expand as the relationships between language and other areas of life are examined. Indeed, applied linguistics has also raised new questions which has driven subsequent theoretical research (e.g., the concept of "nativeness" in language proficiency; A. Davies, 2007), and such bidirectional information flow thus enables both to benefit from each other's research directions.

9.5 The future of linguistics

Given these exciting developments in linguistics, how will linguistics continue to evolve in the coming years? There are three important motivations in contemporary society that I believe will shape the linguistics of our time (see also Mansfield & Wilcox, 2025). The first is technology: Advancements in computing, artificial intelligence, and telecommunications continue to bring new challenges to the use of language across various media and platforms, and the rapid pace of research in fields like quantum computing and machine learning will inevitably affect the sphere of linguistics. The second is inequality: Greater recognition of social, political, and linguistic inequality continues to drive discourse about language use, multilingualism, language pedagogy, language attitudes, language policy, and language documentation. The third is methodology: The increasing emphasis on rigour in the social sciences will encourage linguistics to move towards greater empiricism, relying on large-scale statistical corpus analyses, experimental approaches, and better open science practices to improve the reliability of the data and theories within linguistics.

9.6 Conclusion

As linguistics heads into the twenty-first century, it continues to grow in scope and breadth, as new evidence, ideas, methods, and research directions are incorporated into the field. This interdisciplinarity is a particular strength of linguistics, which recognises the nuanced and multifaceted nature of the phenomenon known as language. Such diversity also means that any individual dimension of language cannot be considered purely in isolation; rather, a holistic view requires multiple perspectives and approaches. Cross-domain work will also help to clarify the relationships between different subfields of linguistics, thereby improving our understanding of linguistics itself. There remains much more work to be done on language and on linguistics, and it will be exciting to see what the remainder of the twenty-first century has in store for the study of language.

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